Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

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General Certificate of Education
January 2003
Advanced Level Examination

AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

COMPUTING CPT4
Unit 4 Processing and Programming Techniques

Thursday 23 January 2003 Morning Session

No additional materials are required.
You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

Information
- The maximum mark for this paper is 65.
- Mark allocations are shown in brackets.
- You will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate.
- The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

Answer **all** questions in the spaces provided.

1 (a) (i) The birds Pheasant, Teal, Widgeon, Partridge, Woodpigeon are entered, in the order given, into a linked list so that they may be processed alphabetically. Draw this linked list.

(2 marks)

(ii) Redraw the list after two additional items, Grouse and Snipe, are added.

(2 marks)

(b) This linked list is said to be a *dynamic structure*. What is meant by the term dynamic structure?

.....

.....

(2 marks)

(c) Explain how memory was allocated for the two additional data items.

.....

.....

(2 marks)

8

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2 For each of the following situations, state which of the terms *multi-programming*, *multi-user* and *multi-tasking* **best** describes the type of operating system involved.

(i) A user on a standalone PC is working on a report which involves switching between a word-processed document and a spreadsheet, while occasionally looking at the Internet for information.

.....

(ii) A computer system is running in batch mode overnight with a queue of jobs to be done. While one job is waiting for input or output, another job is using the processor.

.....

(iii) A number of terminals communicate with a central computer which allocates processing power to each terminal in turn.

.....

(3 marks)

3

3 A *binary* search and a *linear* search are two different methods of searching a list.
A given list contains 137 items.

(a) (i) What is the maximum number of items accessed when searching for a particular item from the given list using a binary search?

.....

(ii) Explain your answer.

.....

.....

(b) (i) What is the maximum number of items accessed when searching for a particular item from the given list using a linear search?

.....

(ii) Explain your answer.

.....

.....

(4 marks)

4

4

```
P:\TL01>cd May 2001

P:\TL01\May 2001>dir
  Volume in drive P has no label.
  Volume Serial Number is E04F-F00A

  Directory of P:\May 2001

.           <DIR>          28/05/01 11.37a
..          <DIR>          28/05/01 11.37a
Seniors     <DIR>          30/05/01 04.16p
Juniors     <DIR>          30/05/01 04.15p
Summer                92,160 31/05/01 10.37a
            5 File(s)     92,160 bytes
```

(a) What type of operating system interface is shown above?

.....

(1 mark)

(b) What program receives the instructions entered via this interface and analyses them?

.....

(1 mark)

(c) Give **two** advantages of this type of interface over alternative types of operating interface.

1 .....

.....

2 .....

.....

(2 marks)

(d) Give **one** disadvantage of this type of interface over alternative types of operating system interface.

.....

.....

(1 mark)

5 (a) (i) Convert the hexadecimal number BD93 to binary.

.....

(1 mark)

(ii) The contents of register A is 1011 1010 0000 0011.
These bits are a representation of a number in twos complement, with the leftmost 10 bits as the mantissa and the rightmost 6 bits as the exponent.

Convert this number into decimal. Use the space below to show your working.

.....

(3 marks)

(b) Give **two** reasons why floating point numbers are normalised.

1. .....

.....

2. .....

.....

(2 marks)

6

6 (a) The Arithmetic-Logic Unit (ALU) is that part of the processor which performs operations on the data. *Arithmetical* and *logical* are two different types of operation.

ADD is an arithmetic operation; AND is a logical operation. Both combine two sets of binary digits. What is the difference between their operation?

.....

.....

.....

(2 marks)

(b) (i) In order to process data, a sequence of operations is frequently required. As each of these operations is executed, where are the results stored?

.....

(1 mark)

(ii) Why is it more efficient storing intermediate results in this location rather than in main memory (IAS)?

.....

.....

(2 marks)

5

7 In a simple logic processing language, a family group is connected by the following facts and rules.

(1) father (alan, edward)
(2) father (chris, fiona)
(3) father (chris, jane)
(4) father (edward, liam)
(5) mother (barbara, edward)
(6) mother (diana, fiona)
(7) mother (diana, jane)
(8) mother (fiona, liam)
(9) mother (jane, michelle)
(10) grandfather (W,X) IF father (W,Z) AND mother (Z,X)
(11) grandfather (W,X) IF father (Z,X) AND father (W,Z)

Clause (1) says that alan is the father of edward.
Clause (10) says that W is the grandfather of X if W is the father of Z and Z is the mother of X.

(a) Use the above information to find liam's grandfathers, clearly identifying the relevant clauses in each case.

.....

.....

(2 marks)

(b) Two people are cousins if they have the same grandfathers. Write a clause which would define cousin.

.....

.....

(3 marks)

(c) Logic programming is particularly suited to specific types of problem.
Give **two** examples of these.

1 .....

2 .....

(2 marks)

7

8 (a) Describe each of the following addressing modes.

(i) Immediate addressing

.....

.....

(1 mark)

(ii) Direct addressing

.....

.....

(2 marks)

(iii) Indexed addressing

.....

.....

(2 marks)

(b) Storage locations 120 onwards hold the values as shown below.

120	1
121	2
122	3
123	4
124	5
125	6

The following instructions are part of a program. If the accumulator and register X both initially hold the value zero, what value would each hold after **each** instruction in the program is executed?

	Instruction		Acc	Reg X
		At start	0	0
(i)	LDX #5	;load immediate 5 into register X	.....	.....
(ii)	LDA #120	;load immediate 120 into Accumulator	.....	.....
(iii)	ADD 120	;add direct 120 into Accumulator	.....	.....
(iv)	ADD X (120)	;add indexed 120 into Accumulator	.....	.....

(4 marks)

9 (a) How could an operating system allow two files with the same filename to be stored on the same floppy disk?

.....

.....

(1 mark)

(b) Immediately after formatting a new 1.44 Mb floppy disk, the following message appears on the screen:

Bytes free = 1,457,664

On checking the properties, the capacity is said to be 1.38 Mb. Give **two** reasons why all of the disk capacity is not available to the user.

1 .....

.....

2 .....

.....

(2 marks)

(c) The *file management sub-system* and the *memory management sub-system* are called when a command is entered to load an executable file from disc. Describe the role of each of these sub-systems in this operation, and state **one** error that **each** might have to deal with.

(i) The file management sub-system

.....

.....

.....

Error .....

(3 marks)

(ii) The memory management sub-system

.....

.....

.....

Error .....

(4 marks)

10 (a) State **two** advantages of the object-oriented approach to program design over the structured approach to program design.

1 .....

.....

2 .....

.....

(2 marks)

(b) A sailing club has both junior and senior members. Each member has a unique membership number, a name and an address recorded. Three classes have been identified:

Member
JuniorMember
SeniorMember

The classes JuniorMember and SeniorMember are related, by single inheritance, to the class Member.
Draw an inheritance diagram for the given classes.

(2 marks)

(c) Programs that use objects of the class Member need to add a new member's details, amend a member's details, and show a member's details. No other form of access is to be allowed. Write a class definition for this class.

Member = **Class**

.....

.....

.....

.....

.....

.....

End;

(4 marks)

END OF QUESTIONS